

# Roman Pot Acceptance Summary

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BNL EIC Science Task Force Meeting

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# Overview

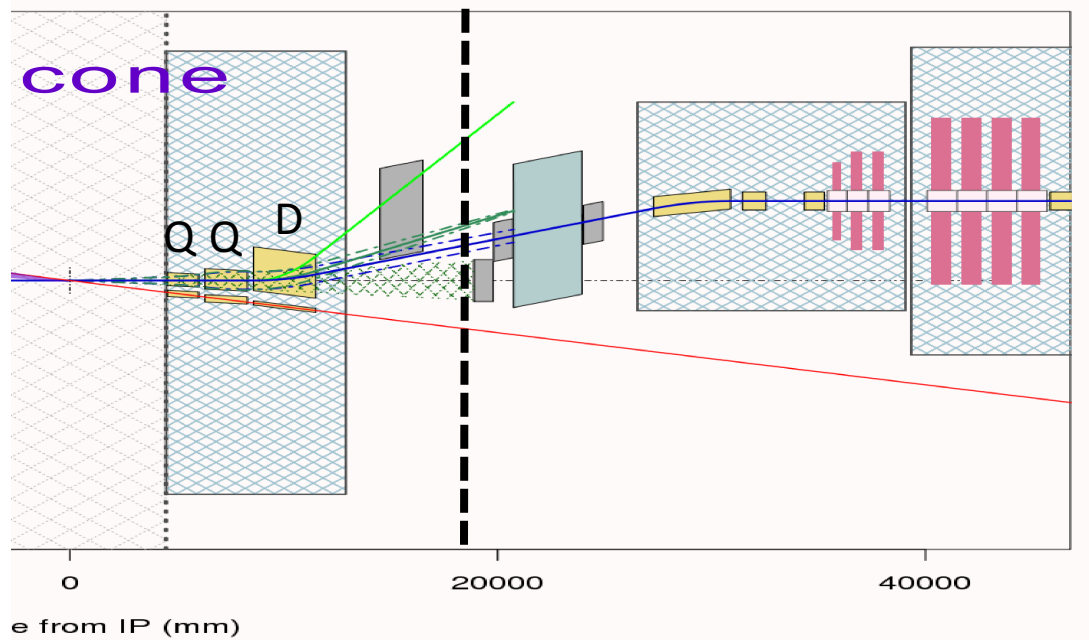
- Options galore
  - Linac-ring, versions 2.1 and 3.0
  - Ring-ring v1.1
- Some code changes to make this happen
- Results

# Linac-Ring

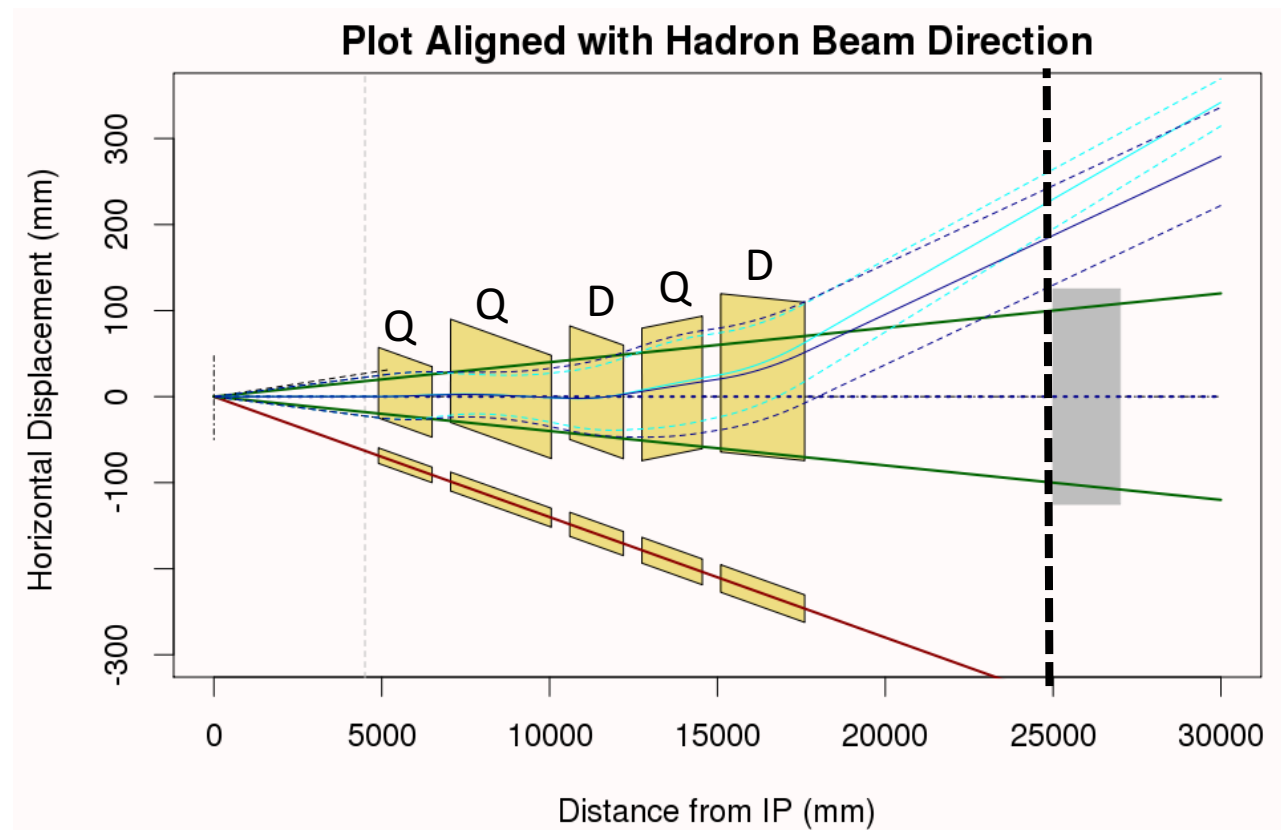
- Brett Parker is working on the linac-ring IR design
- He has addressed some of the issues that were raised on the old (v2.1) design in regards to the forward going proton acceptance
- Only developed the forward proton going side so far for v3.0
- Next slide shows a comparison of the two designs

# Linac-Ring layout

v2.1

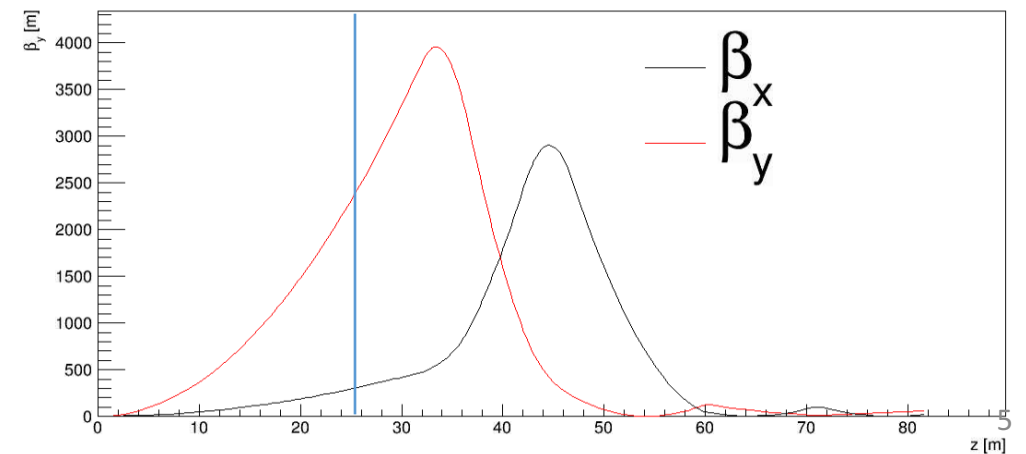
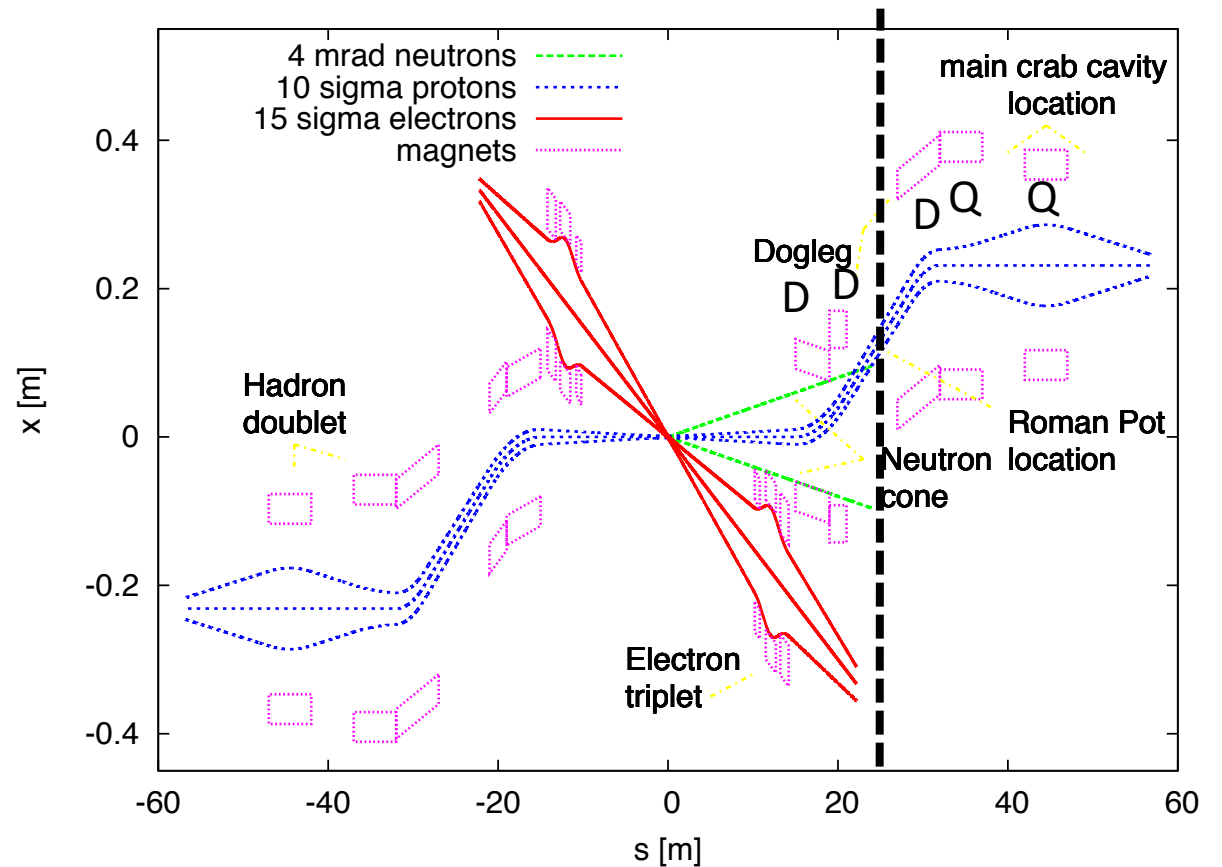


v3.0



# Ring-Ring design

- Design by Christoph Montag
- One notable difference is that the hadron magnets are pushed back much farther from the IP (at ~15m compared to ~5m in linac-ring)
- Also beta function is much smaller in the location of the roman pots for this design
- (Robert Palmer working on yet another design)

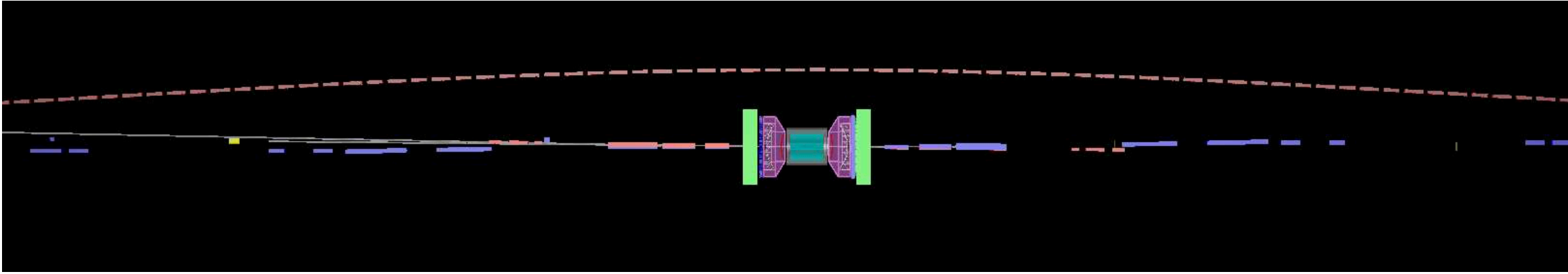


# Code changes required

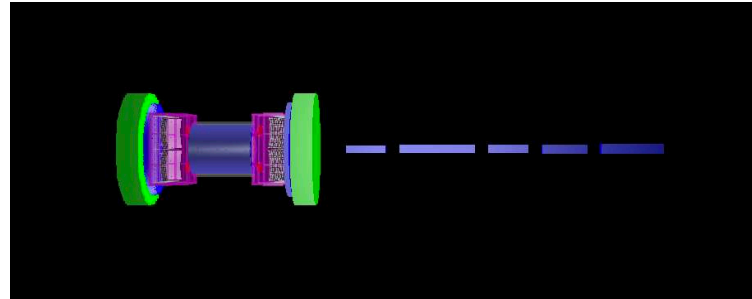
- Expanded classes in EicRoot to import and implement a new way of information transfer for magnets
  - Assumes perfect magnets (i.e. ignores edge fields, etc.) but is good for now
- Previously had a complicated procedure to produce field maps
  - In a single file, encoded magnet placement and a grid of field strengths
  - Each magnet had its own file
  - Terrible way, took multiple people in CAD to produce maps, resulting in us receiving only ONE design (though presumably more detailed information than now in use)
- New way is much simpler
  - Have a single file for each beam
  - One line for each magnet
    - Magnet\_name center\_z center\_x center\_y bore\_radius rot\_angle field\_strength gradient
  - The field is calculated for each GEANT step directly from the coordinates
  - Will foster more collaboration and quicker iteration of design

# IR layouts in EicRoot

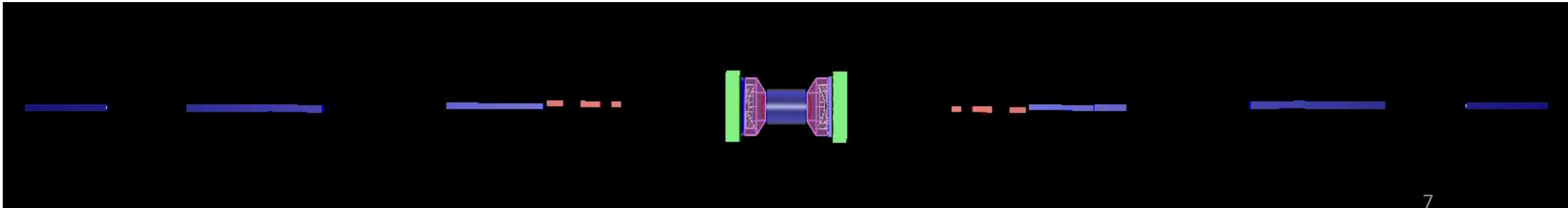
v2.1\_  
LR



v3.0\_  
LR



v1.1\_  
RR



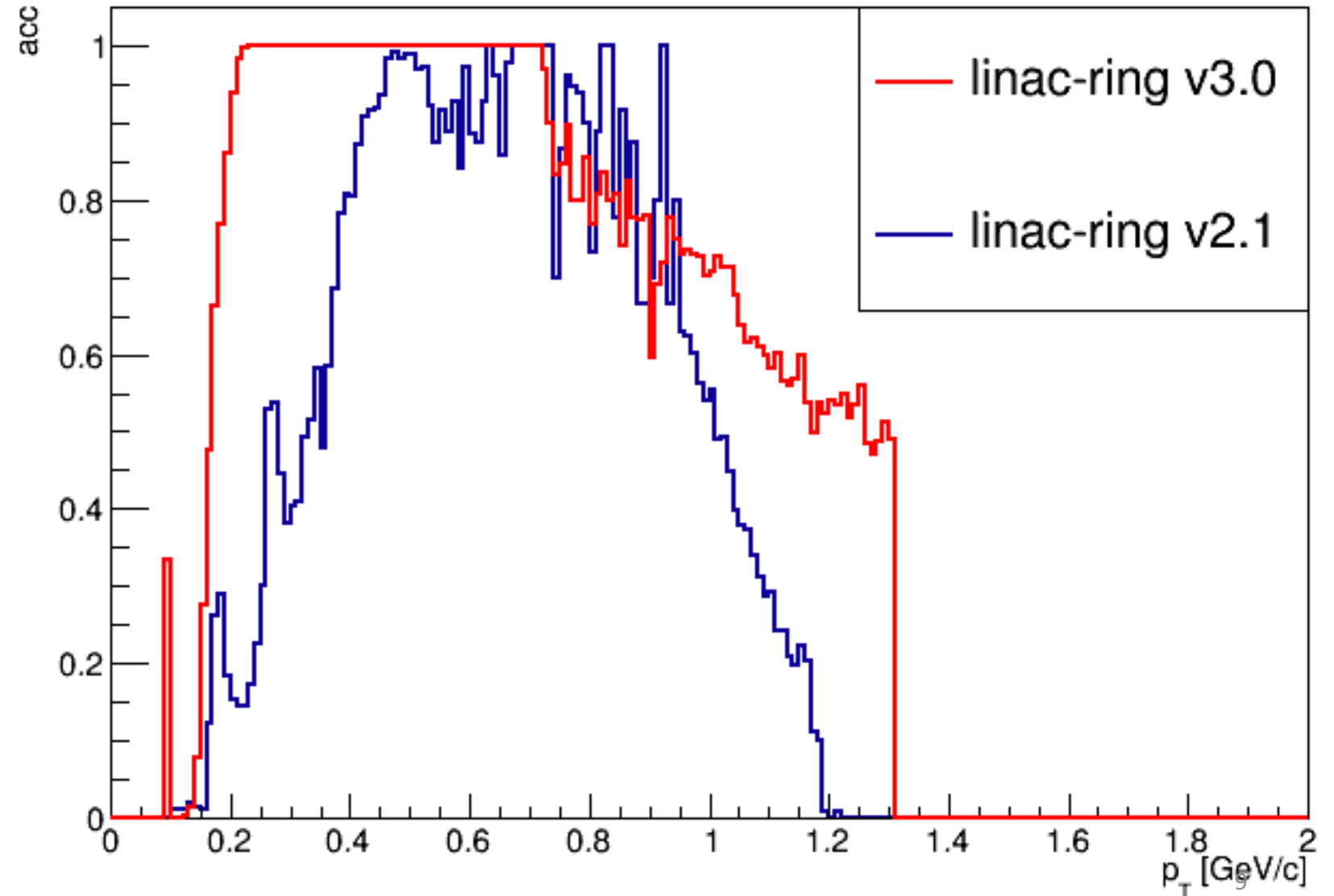
# Acceptance plots for the roman pots

- All simulations use the identical MILOU simulation files of DVCS events
- All events originate from (0,0,0)
- Simulation does not account for beam divergence effects at the IP
- All simulations have the roman pots placed appropriately close to the beam
  - 10 sigma from the beam center calculated from the beta function in x and y
- Placement in z of the roman pot is adjusted for each case
  - 18m for linac-ring v2.1
  - 25m for linac-ring v3.0
  - 28m for ring-ring v1.1
- Simulations only have one beam line in place (sometimes the other beam line blocks path, this needs to be discussed with CAD)
- Neglected to place main detector solenoid – this can have some effect on protons with a larger angle

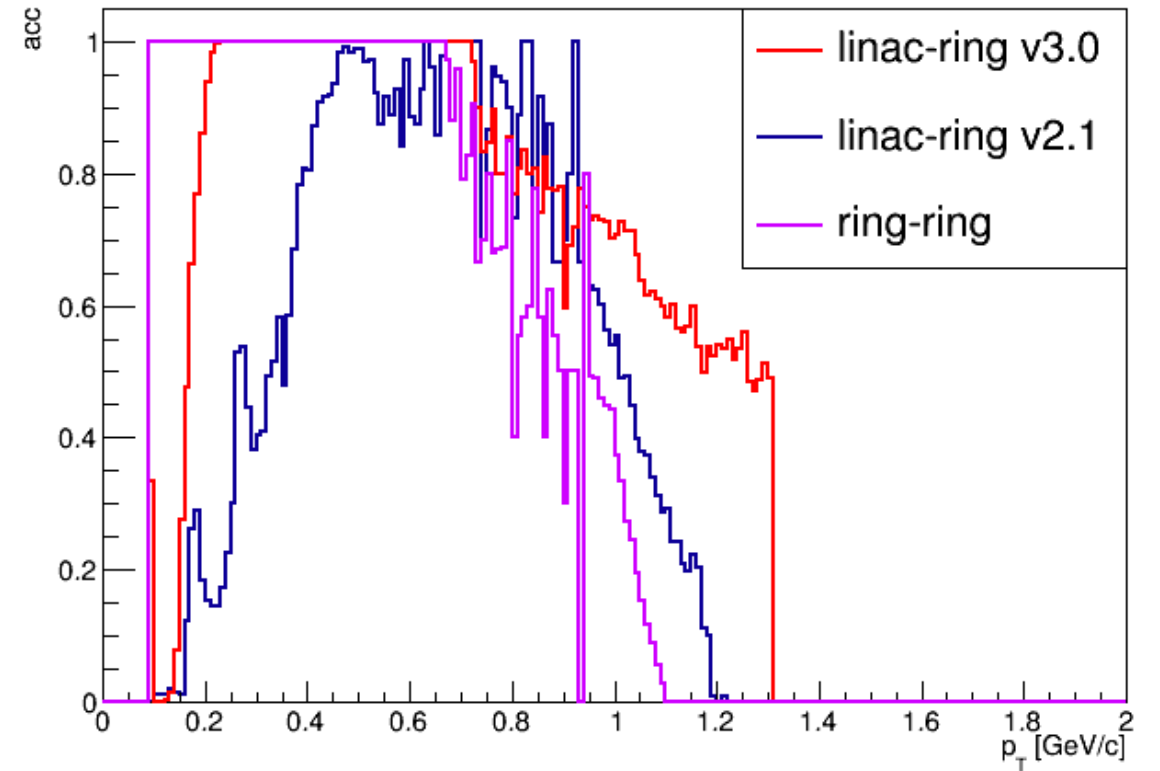
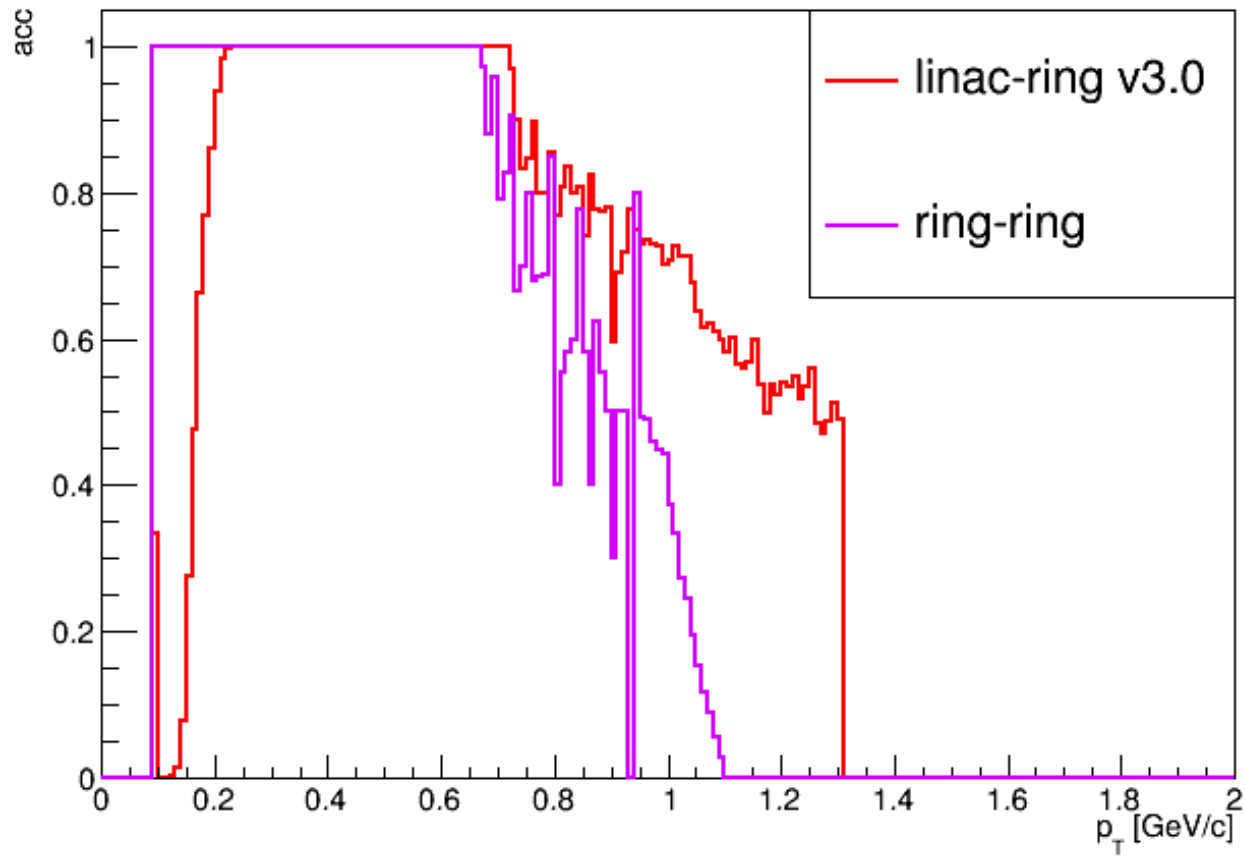


# Linac-Ring Design – compare v2.1 and v3.0

- Still slight issue with alignment of magnets in v3.0
  - Neutral and proton lines of +4mrad does not make it through
- Acceptance is much improved!



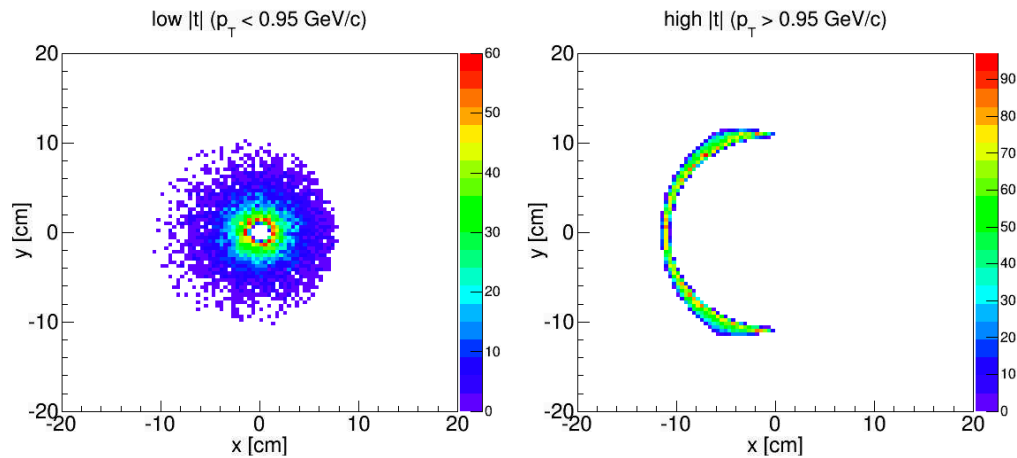
# Ring-Ring and Linac-Ring Comparison



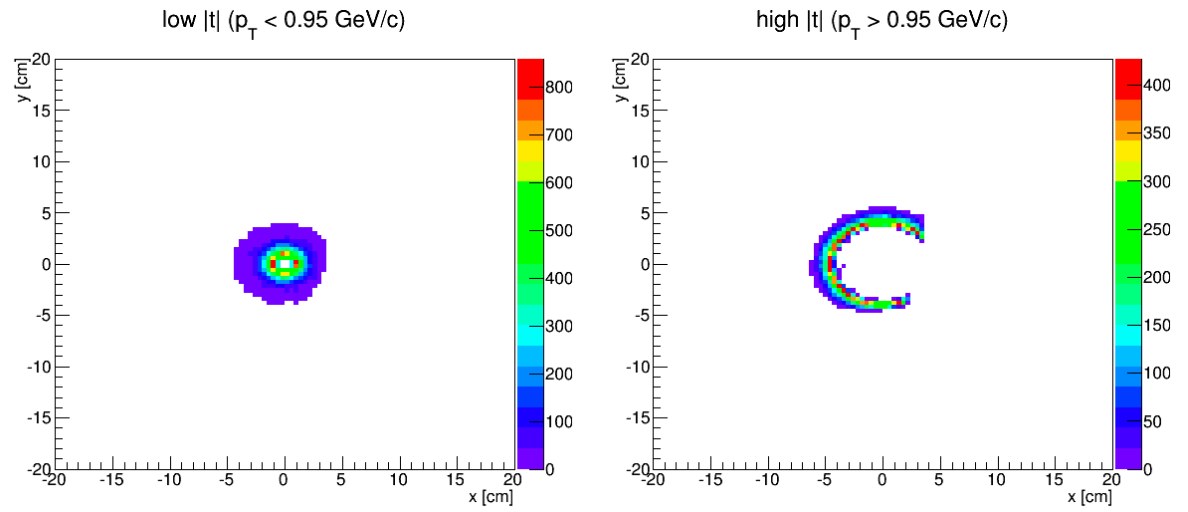
# Hit maps on the roman pot for each design

- Lose protons that scatter to one side of the nominal beam line

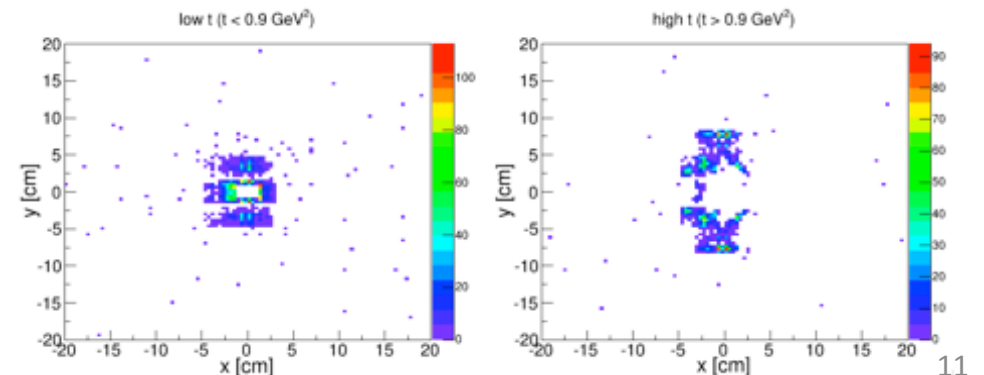
Ring-ring v1.1



linac-ring v3

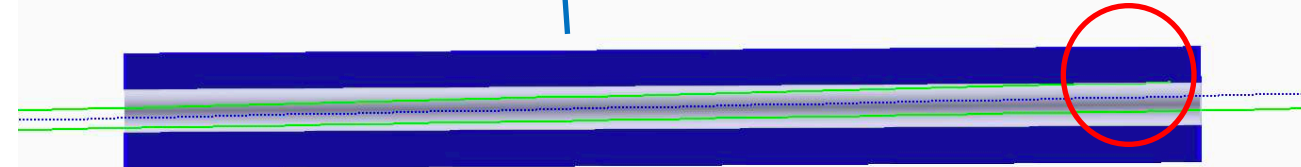
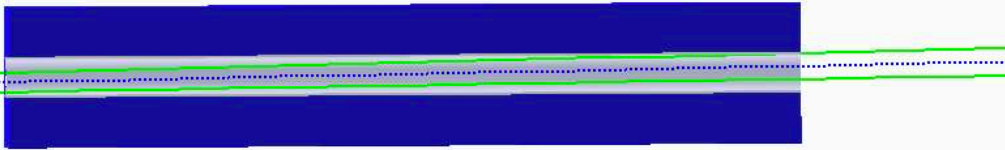
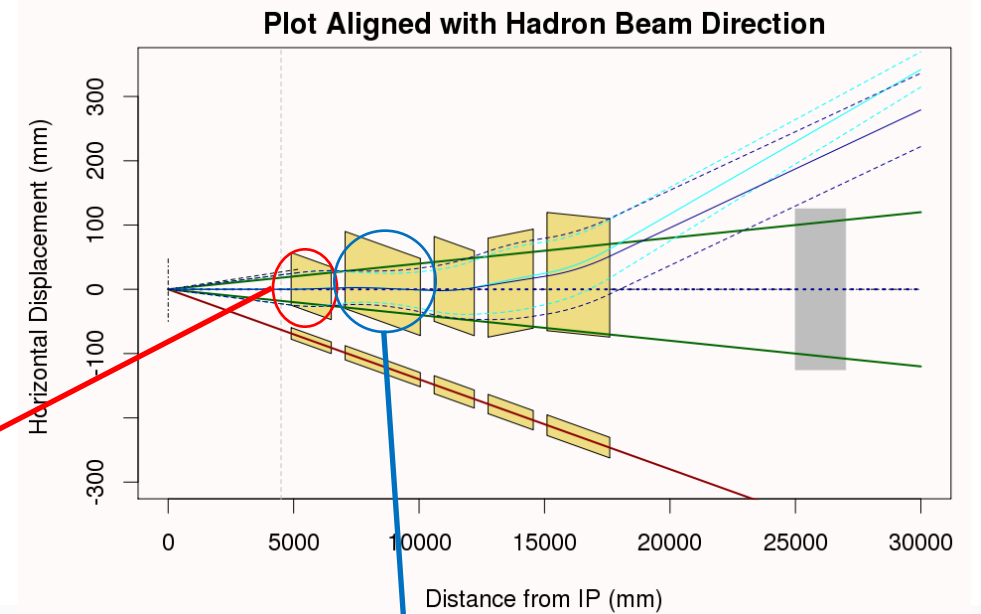


linac-ring v2.1



# Still some issues – alignment problems?

- Evidence of some alignment issues for the linac-ring v3.0 design
- Green lines represent  $\pm 4\text{mrad}$  neutron cone edges
- Line hits side of second quad
- Same happens for protons



# Summary

- Ring-ring design does the best at low pT
  - Smallest beta function at the roman pot location, so roman pot can be placed very close to beam
- But ring-ring does the worst at high pT
- Linac-ring v3.0 is much improved from v2.1 at high pT
  - Still need to simulate low pT events
  - Still have an alignment issue to look into

# Backups

